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MEMOIRS
OF THE
GEOLOGICAL SURVEY
OF
THE UNITED KINGDOM.

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*Figures and Descriptions*

ILLUSTRATIVE OF  
BRITISH ORGANIC REMAINS.

—  
DECADE III.  
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NOTICE.

PALÆONTOLOGICAL researches forming so essential a part of geological investigations, such as those now in progress by the Geological Survey of the United Kingdom, the accompanying plates and descriptions of British Fossils have been prepared as part of the Geological Memoirs. They constitute a needful portion of the publications of the Geological Survey, and are taken from specimens in the public collections, or lent to the Survey by those anxious to advance this branch of the public service.

The plan proposed to be followed in the work, of which this Decade forms a part, is as follows :—

To figure in elaborate detail, as completely as possible, a selection of fossils, illustrative of the genera and more remarkable species of all classes of animals and plants the remains of which are contained in British rocks ; to select especially such as require an amount of illustration which, to be carried out by private enterprise, would require a large outlay of money, with little prospect of a return, and a long time to accomplish, but which, by means of the staff and appliances necessarily employed on the Geological Survey, can be effected at small cost, and with a rapidity demanded by the publication of the Maps and Memoirs of the Survey ; thus, it is hoped, affording an aid to those engaged in the sciences with which this work is connected, that they might not otherwise have possessed, and which may materially promote the progress of individual research.

H. T. DE LA BECHE,
Director-General.

*Geological Survey Office, Jermyn Street,
30th June, 1850.*

BRITISH FOSSILS.

DECADE THE THIRD.

THE third Decade of representations of British Fossils follows up the subject of the first, and continues the series of illustrations of the genera and species of extinct Echinodermata, especially those belonging to the orders *Asteriadae* and *Echinidae*.

The genera illustrated in this Decade are partly new, partly long-established ; so also with the species, some of the most remarkable of unpublished forms having been selected, as well as some of the commonest and best known fossils. Yet, even respecting those which are so familiar that their whole history is believed to have been long ago made out, there is so much to be cleared up, so many points of structure hitherto very imperfectly or not at all elucidated, and such an accumulation of synonyms, that their investigation is much more laborious, and occupies much longer time, than inquiries into entirely new types. Thus, three of the fossils figured and described in this Decade, *Hemicidaris intermedia*, *Galerites albogalerus*, and *Micraster cor-anguinum*, are so familiar to geologists and naturalists, so abundant and so well preserved, that authors do not hesitate to cite them without comment, as if they were free from any obscurity. Nevertheless, I may say confidently, that not until now has the literature of these well-known and often-described forms been cleared up, and many of the most important points in their organization made known. Common as they are, no representations of them, presenting sufficient details of their structure, have ever appeared before.

Among the new forms now first described and figured, some are of singular interest. Two of them, the *Lepidaster Grayii* and the *Tropidaster pectinatus*, are not only new as species, but unquestionably possess features entitling them to become the types of new genera. Of those

belonging to old genera, the *Uraster Gaveyi* is singularly interesting, presenting, as it does, the spectacle of a Liassic echinoderm, which so closely resembles the commonest star-fish now living in the British seas, that it can only be distinguished from it by a minute and critical comparison; and the *Hemicidaris Purbeckensis* is remarkable as being the first member of its tribe ever discovered in strata of the Purbeck series.

The species described and figured have been selected from formations of different geological epochs. From Silurian rocks *Lepidaster Grayii* has been taken; from older secondary strata, the two forms of *Hemicidaris*, the *Galerites (Holectypus) hemisphærica*, chosen on account of its being new to Britain, and also affording an excellent illustration of the sub-genus to which it belongs, and the *Dysaster ringens*, selected for the same reasons; also the new star-fishes, species of *Uraster* and *Tropidaster*, already alluded to. Of cretaceous fossils there are the critical *Galerites castaneus*, and the characteristic *Galerites albogalerus* and *Micraster cor-anguinum*.

A third series of illustrations of the fossil Echinoderms is far advanced, and in preparation for publication.

EDWARD FORBES.

June, 1850.

BRITISH FOSSILS.

DECADE III. PLATE VI.

GALERITES (HOLECTYPUS) HEMISPHERICUS.

[Genus GALERITES. LAMARCK. (Sub-kingdom Radiata. Class Echinodermata. Order Echinidæ. Family Cassidulidæ.) Body more or less hemispherical, always tumid; ambulacra simple, continuous, radiant; mouth central, inferior; anus inferior or sub-marginal; tubercles perforate.]

[Sub-genus *Holactypus*. Body hemispheric, circular; tubercles in regular series; inside without ribs.]

SYNONYMS. *Discoidea hemisphærica*, AGASSIZ, Cat. Syst., p. 7. DESOR, Monog. des Galerites, p. 71, pl. 8, figs. 4-7 (1842). *Holactypus hemisphæricus*, AGASSIZ and DESOR, Cat. Raisonné des Echinides, Ann. des Sciences Nat., 3rd Series, vol. vii., p. 146.

VAR. β . *Depressus*. *Discoidea marginalis*, M'COY, Ann. Nat. Hist., 2nd Series, vol. ii., p. 413 (1848).

VAR. γ . *Conicus*, anus valde marginalis. *Holactypus devauxianus* COTTEAU, Etudes sur les Echinides Fossiles, p. 46, pl. 2, figs. 7-9 (1850).

DIAGNOSIS. *G. (H.) testâ tumidâ, hæmisphæricâ, plus minusve depressâ, margine rotundato; ano marginali; tuberculis in facie ventrali crebris, ad orem sensim majoribus.*

The genus *Holactypus* has been founded by M. Desor for such oolitic *Galerites* as have the aspect and regular arrangement of tubercles distinguishing the genus *Discoidea*, but have not the internal ribs which cause such deep indentations in the casts of specimens of the latter group. They constitute a transition from the *Discoideæ* to the typical *Galerites*, and, according to my views, form a section or sub-genus of the genus *Galerites*, more valuable on account of their palæontological merits and limited distribution in time (being in the main characteristic of the oolitic period) than for the zoological importance of the characters of their organization, which are rather transitional than distinctive.

The type of the sub-genus *Holactypus* is the *Galerites depressus*, a fossil very abundant in British oolites, and having wide vertical and horizontal range. The species now figured is conspicuously distinguished from *G. depressus* by having a marginal instead of a vertical anus, and the tubercles of its under surface very numerous and gradu-

ally enlarging towards the mouth, instead of being comparatively few and suddenly becoming large and scattered in that region. Its body is also more rounded and tumid at the margin, although that character varies slightly according to the degree of convexity of the dorsal surface.

The only *Holcotypus* described in the Monograph of the Galerites by Desor, with a marginal anus, is the *H. hemisphaericus*, and the figures and description given by that author are sufficiently characteristic of the British species now under examination, so that I do not hesitate to adopt Desor's name. Its general outline is sub-hemispherical, varying in convexity in different individuals. Specimens are rarely quite regularly convex, but most commonly have a slight obliquity, and are very slightly elongated and declining on the side towards the anus; consequently the vertex in such examples is not quite central, though constantly apical.* The sides are gently tumid, so as to round off the margins gradually. The ventral surface is more or less hollowed out in the centre, often very much so. In the depth of the concavity, and nearly or quite central, is the mouth, occupying less than one-third of the disk, round, with ten deep marginated notches separated by gently curved interspaces, and placed close to the junctions of the interambulacral areas with the ambulacral avenues. The ambulacral areas are a third or more of the breadth of the interambulacra, their proportionate dimensions increasing generally with the altitude of the individual, and lessening usually with age and size. The pairs of pores of the avenues are ranged in single file; they are slightly more distant from each other on the under than on the upper surface, but those very near the mouth are closely set again. There are about four pairs, or four and part of a fifth, opposite each interambulacral plate towards the middle of the upper sides. In a specimen slightly above an inch in diameter, I counted twenty-six interambulacral plates in a series, and ninety-four ambulacra, each of the latter representing a pair of pores. Each of the interambulacral plates is thickly studded with minute granules, in the midst of which are the spiniferous tubercles, scattered and varying in number in different individuals. I have found some specimens, closely alike in all other respects, varying in the number and arrangement of these tubercles, of which there are sometimes two rows on a plate, at others only one. In those examples which present the most regular arrangements, the tubercles are so disposed on the assemblage of interambulacral plates, that each half area exhibits a curved line of them rising to alternate at the suture with a similar curved line on the corresponding half area. On the ambulacral areas the tubercles

* I use the term "vertex" to denote the highest point of the back, and "apex" to indicate that point to which the ambulacra converge and where we find the ovarian disk.

are also present, forming more or less regular oblique rows of three, sometimes of two, and with but slight traces of arrangement. The tubercles become crowded towards the margin, and are thickly distributed on the ventral surface, very regularly increasing in size towards the mouth, immediately around which they are often fewer again and more wide apart. Each tubercle is perforated on its summit, and has its base borne upon an areolated boss. In very complete specimens, the margin of the areola is surrounded by a ring of areolated granules, which, when highly magnified, exhibit traces of perforations on their summits, as represented in the plate. The spines are unknown.

The apical disk is formed of five genital and five ocular plates. The odd genital plate, that opposite the anal interambulacral area, is smaller than the rest, and imperforate. The other four are conspicuously perforated for the oviducts. The left genital plate is larger than the rest, occupies the centre of the disk, and is formed in part of the madreporiform tubercle, which in some specimens is very prominent and always conspicuous. The eye-plates are small and pentagonal; they are, as usual, placed opposite the terminations of the avenues, and are perforate at their lower parts, but still at some little distance from their margins, by the eye-holes, which in this species are large and conspicuous. [In Plate II., fig. 7, of Desor's Monograph of *Galerites*, the eye-holes of *G. (Holectypus) depressus* are represented as marginal, but an examination of them in British specimens of that species has convinced me that their true position is such as I now describe in *G. hemisphæricus*. The madreporiform body is there described as distinct from the ovarian plates, and the imperforated ovarian plate as largest in the circle, both which statements are, as I interpret the structure, errors.] The anus is placed in the lower and marginal half of the odd interambulacral area; it is pointed above, rounded below, so that its general outline is somewhat pyriform, or rather drop-shaped. In what may be considered normal examples, its widest diameter is about equal to the distance between its lower margin and the mouth; but almost every specimen varies slightly in this respect, and the result of an examination of more than fifty specimens has convinced me that, further than the constant marginality of the anus, the exact proportion its lower part bears to the ventral disk is not to be received as a specific character. Its breadth also varies in different individuals, in all other respects exactly similar.

Varieties.—Variations in convexity and in proportion of breadth to height are very conspicuous in this species, and among a number of specimens from any one locality very few will be found in this respect exactly alike. The other points of variation are the distance between the anus and the mouth, and the number and regularity of the tubercles.

There are three principal forms conspicuous among these varieties, which, if separated from each other in collections, might seem specifically distinct, but between which every gradation of transition may be found. The first of these is the more or less regular sub-depressed hemispheric form, most common, and apparently the normal one. Its most convex state closely approaches the conical variety, which is represented in the original figure of *Discoidea hæmisphærica*. This, on one side, passes into a small very convex variety, having the anus more than usually marginal, in which state it appears to constitute the *Holcotypus devauxianus* of Cotteau, with whose figures and descriptions we have English specimens perfectly according. On the other side it becomes more and more depressed, until we get it only gently convex on the back. Specimens of this kind seem to have constituted the *Discoidea marginalis* of M'Coy, said to be "very abundant in the inferior oolite of Bridport," and respecting the identity of which with the species here described I entertain not the slightest doubt. In order to show the variations of dimensions in this species, I give the following measurements of ten Dorsetshire specimens in the collections of the Geological Survey:—

No.	Locality.	Breadth.	Height.	Anus to Mouth.
		Inch.	Inch.	Inch.
1	Stoke Knaps (β) . . .	1	$0\frac{5}{12}$	$0\frac{3}{12}$
2	Loders	$1\frac{1}{12}$	$0\frac{1}{12}$	$0\frac{2\frac{1}{2}}{12}$
3	Crewkerne	$1\frac{2}{12}$	$0\frac{8}{12}$	$0\frac{3}{12}$
4	Crewkerne	$1\frac{1}{12}$	$0\frac{8}{12}$	$0\frac{2\frac{1}{2}}{12}$
5	Stoke Knaps	$1\frac{4}{12}$	$0\frac{8}{12}$	$0\frac{3}{12}$
6	North Nibley	$1\frac{2}{12}$	$0\frac{8\frac{1}{2}}{12}$	$0\frac{2\frac{1}{2}}{12}$
7	Castle Cary (γ) . . .	$0\frac{8}{12}$	$0\frac{7}{12}$	$0\frac{3}{12}$
8	Stoke Knaps (γ) . . .	$0\frac{9}{12}$	$0\frac{6}{12}$	$0\frac{3}{12}$
9	Shipton Gorge	$0\frac{10}{12}$	$0\frac{5}{12}$	$0\frac{2\frac{1}{2}}{12}$
10	Bridport Harbour (γ) .	$0\frac{7}{12}$	$0\frac{4}{12}$	$0\frac{2}{12}$

Locality and Geological Position.—During the examination of the INFERIOR OOLITE strata in Somersetshire and Dorsetshire by the members of the Geological Survey, this species was collected abundantly, chiefly in the sands of the Inferior Oolite, in numerous places, associated in most instances with *Dysaster ringens* and often *Dysaster bicordatus*. The following is a list of the principal localities in which it was found: Hazelbury, Crewkerne, Lyttelton Hill near Cadbury, Whatley near Frome, Little Windsor, Loders (top beds), Stoke Knaps, Greenland, Compton Pauncefoot (bottom beds), Pilcombe, Bruton, Shipton Gorge,

Burton Bradstock, and near Burton Castle (top beds), Bridport Harbour, Chideock Hill, Mapperton, West Swillets, Beaminster. These localities are all included in sheets 18 and 19 of the Ordnance Map of England. The specimens were collected by Mr. Bristow and Mr. Gapper.

Foreign Distribution.—"In Normandy, in a particular bed of the Calcaire au Polypiers, known by the name of Caillasse." (Desor.) "In the Inferior Oolite of the Tour-du-Pré associated with *Dysaster ringens* and *Diadema depressum*." (Cotteau.)

EXPLANATION OF THE PLATE.

- Fig. 1. Normal form seen from above.
 Fig. 2. Under view.
 Fig. 3. End view, showing the anus.
 Fig. 4. Profile.
 Fig. 12. Extremely depressed specimen (var. β), seen endways.
 Figs. 13 and 14. Outlines of end, over and under side of extremity, conical dwarf variety (var. γ).
 Fig. 5. Arrangement of ambulacral and interambulacral plates and pores on the sides.
 Fig. 6. Ditto on the base.
 Fig. 7. Mode of duplication of the notches of the mouth-margins; and arrangement of the oral terminations of the avenues.
 Fig. 8. Apical disk, showing the arrangement of the genital and ocular plates, and the madreporiform tubercle.
 Fig. 10. Tubercle and granules of dorsal surface highly magnified.
 Fig. 11. The same from the ventral surface.

Note on allied species of Galerites found in Britain.

The only British *Galerites* of the section *Holactypus*, besides the one described above, is the *G. depressa*, a species which accompanies *G. hemispharica* in most of the localities cited, and which has a much wider distribution, occurring, in England, in inferior oolite, where it appears to be most abundant, in fullers' earth and in cornbrash. It is at once distinguished from *G. hemispharica* by the position of the anus, which is entirely ventral, very large, extending from very near the mouth to the margin of the under surface, and of an oblong pyriform shape, pointed at its inner end, and widest towards its marginal termination a little beyond half its length. The dorsal surface is depressed, yet regularly convex, the margins rounded, but having a tendency to compression, consequently the greatest breadth of the entire body is in the diameter immediately above the margin. The spiniferous tubercles of the dorsal surface are very small; they are very numerous near the edge, but become fewer and more scattered, though very conspicuous and comparatively large, on the ventral surface, as they approach the mouth. Individuals vary greatly in the degree of dorsal convexity. From one inch to one inch and a-half across is the usual diameter of well-grown specimens.

EDWARD FORBES.

June, 1850.

Geological Survey of the United Kingdom.

GALERITES
(Oolitic.)

